

## Biosociological ethodiversity in the social system

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### ABSTRACT

A comprehensive understanding of human sociality needs to embrace the coevolution of genes and culture. Recent advances in biological research about niche construction by organisms, and the development of the concepts of social niche and ethodiversity, can be integrated into a common approach to understand this coevolution, which implies the interaction between sociology and ecology in an integrative framework of knowledge. In this paper the authors propose such inclusive biosociological and heuristic framework to improve the understanding of the evolution of social niche construction. In addition, it allows a better understanding of the concept of sociotype in non-human organisms and explains some aspects of the social or presocial behavior through the concept of ethodiversity.

### 1. Introduction

*Homo sapiens* is a very unusual species, because confronted with a high diversity of local environments, has been able to create an array of cultures with an exceptional variety of learning processes, social situations, and complexity (Van Schaik et al., 2019). The capacity of humans to alter their ecological niche creates a *social niche*, which is likely the reason for human adaptability to very different environments. He et al. (2019) have shown the relevance of the physical configuration of the habitat in the conformation of the social world, namely its social organization and structure. A clear example comes from the Inuit culture, which used female infanticide in an adaptive way (Cordero-Rivera, 2014). In the early XX century, before Western legal regulations changed Inuit behaviour, there was a positive relationship between the average annual temperature (a measure of the severity of the environment) and the proportion of girls in different Inuit villages (Irwin, 1989). Female infanticide was more intense in the coldest areas (with a correlation of  $r = 0.85$ ), but among the adults, sex-ratio was biased to women, due to the high mortality of young adult males. Thus, female infanticide was a cultural method to manipulate sex-ratio, given that biological manipulation of sex-ratio was not possible. Examples like this, which show changes in human culture to cope with environmental severity, suggest that the ontology of the human social system is an integrative *biosocial*

structure, currently known as “social niche” (Saltz et al., 2016). The concept of social niche, as we will see below, is related to the theory of niche construction and the importance of this theory in the understanding of social interactions in the field of evolution. In this sense, the idea of ethodiversity and its relationship with biosocial structure will be framed in this theory.

This biosocial structure also includes mechanisms of non-genetic inheritance (Laland et al., 2015; Sukhovkhov and Gontier, 2021). To argue that the social system of different organisms has a biological basis does not imply underestimating the consequences of the intervention of organisms in the environment (Sanchez, 2010). In fact, the theory of niche construction emphasizes this aspect (Odling-Smee et al., 2003).

Social systems can be characterised by their social organization, which refers to their size, sexual composition, spatiotemporal cohesion (Aureli and Schino, 2019) and also by their ethodiversity, defined as the variety of behaviors shown by individuals, groups and higher order aggregations (Cordero-Rivera, 2017). Advances in niche-construction theory have identified an evolutionary process where both natural selection and niche construction are needed to understand the reciprocal influences between organisms and the environment (Kendal et al., 2011). In this sense, the diverse behaviour of social species and the process of niche construction are mediated/regulated by semiotic processes (Gare, 2019; Barbieri, 2009; Sukhovkhov, 2014).

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Fuentes (2017) defines the human niche (social niche) as the spatial, ecological and social spheres that condition the evolution of the individuals. The different modalities of human cultures are developed and reinforced by perceptual/behavioural patterns, a particularly information-rich communication system, and a wide range of complex pressures and affordances, which constitute the niche itself. This conception of the niche and its interaction in evolution poses a non-linear evolutionary phenomenon.

An ecological perspective is essential for any theory of biological evolution (Hutchinson, 1965) and for any comprehension of social evolution. In this sense, the interaction among social and biological knowledge has been shown to be very relevant to understand the *gene-culture coevolution* (Gintis, 2011; Ross and Richerson, 2014). This process of coevolution is not linear, as previously highlighted by several authors (Buskes, 2013; Sanchez, 2010). Nevertheless, it is possible to continue to discuss gene-culture coevolution in order to show in a simple and heuristic way this biosocial phenomenon. This coevolution implies humans are biosocial beings by excellence, a fact that sometimes Social Sciences forget, for example when sociobiological knowledge was neglected (Cordero-Rivera, 2014). Considering that human behavior is conditioned by social factors (education, economy, health ...) and by our own cultural constructions, it could be argued that biological and social determinants are equally important in our species. This involves admitting that the evolutionary process occurs in four dimensions: the first is genetic, the second epigenetic, the third behavioural and the last dimension would be symbolic (Jablonka and Lamb, 2014). We are, therefore, facing a process of gene-culture co-evolution that is not linear, but reticular.

At this point it is relevant to underline that culture has many definitions. However, for the purpose of this paper, culture is considered as the information acquired in society by a variety of social learning phenomena (Ross and Richerson, 2014), constituting a collective behaviour socially transmitted from others (Fuentes, 2017). These aspects configure, among others, the non-genetic inheritance into societies. Social organisms can improve their societies thanks to the increase of cultural phenomena. These phenomena of cultural improving generate more complexity in social niche by means of an increase in ethodiversity. Then, human ethodiversity could be understood as one of the main biosocial factors of sociotype configuration.

The objective of this article is to highlight the multidimensional perspective (biological, sociological and cultural) of social studies, which is essential to understand human culture. According to Turner and Machalek (2018), this perspective aims to strengthen sociological and ecological research in order to enlarge sociobiological perspectives towards a more sociological conception. For this reason, in this paper we discuss the niche construction theory and the social niche conception in dialogue with the concept of ethodiversity, in order to describe a biosociological and heuristic framework which is relevant to biosociology and social sciences.

## 2. Coevolution and socioecology

The *Niche Construction Theory* (NCT) has been usually defined in the core of a biological model. NCT integrates ecological and evolutionary phenomena in order to explain how niche modification feeds-back to affect evolution of the organisms (Buser et al., 2014). Odling-Smee et al. (2013) show that NCT includes three types of resources: abiotic (physical resources), biota (biotic components of ecosystems) and artifacts (nests, burrows, webs, but also the houses, cars, factories, and computers of humans). For this reason, NCT has a heuristic capacity to elucidate the phenomena of human social/behavioral reality, namely languages, cultural dynamics, technologies, religions, institutions and so on. These phenomena construct an intricate ensemble of abiotics, biotics, and artifacts which define the social niche. We consider that this ensemble can be grasped by the concept of *ethodiversity*.

The importance of the coevolutionary process

(organisms–environment) in evolution was already recognized in the neodarwinian paradigm, leading to the special case of *niche construction* theory (Gintis, 2011). The *niche* is the ecological role of a species within an ecosystem, based in the range of conditions necessary for maintaining a viable population (Polechová and Storch, 2008). In the case of humans, Farina (2010) prefers to use the concept of *landscape domain* which includes several subdomains: religion, culture, economy, policy, and environment. This idea, as it will be shown here, could be very interesting in landscape studies but the niche concept (ecological or social) is also needed when referring to cultural/social aspects. If we recognize that it is into the niche where cultural and social phenomena happen, this fact is of major significance for social evolution. Individuals adjust themselves to the niche configuration through the generation of different behaviours (ethodiversity). Then, the concept of ethodiversity will be a coevolutionary bridge between genetic and non-genetic inheritance. Hence the importance that this concept has for the biosociological understanding of reality.

The neodarwinian paradigm has been refined in the last 40 years, and modern approaches, like the *Extended Evolutionary Synthesis* (EES) show that Natural Selection is the main mechanism for biological adaptation, although other factors like genetic drift, mutation, and gene flow are relevant. Furthermore the epigenetic inheritance and the ability of organisms to modify their environment also influence the evolutionary phenomenon (Fuentes, 2017; Müller, 2017). Moreover, EES considers that the development of populations (societies) assumes a constructive role and causation of evolution that does not run in a single direction. There is a bidirectional transmission of information between the organisms and the environment in which organisms construct their niche and also interpret signs of their own environment. For this, the external environment (cultural niche construction) will be one of the most important factors in the evolution of human populations, conditioning the development of individuals and populations. These brief notions about the extended theory of evolution are important to understand that the theory of niche construction is founded in an extended idea of evolution. An idea in which social studies can investigate in an adequate way without losing its specific and defining character.

“Cultural niche construction did not just impose selection on our bodies, thereby shaping our physical appearance, skin color, susceptibility to disease, and ability to digest foodstuffs, but it also transformed the human mind, leaving our cognition specifically adapted for cultural life.” (Laland, 2017: 230)

In this context, Parker et al. (2016) emphasize the need for scientists to focus research in a biosocial framework, in which historical, political, social and economic relations influence power relations and this can impact and shape ‘local biologies’. Thus, this biosocial framework could help to understand the interrelationships that occur between the biological and the social in the phenomenon of niche construction. This aspect has been studied from different perspectives: ecosemiotics, human ecology, social ecology, etc. We will not delve into these other perspectives and will focus on showing the interrelationship between niche construction theory and ethodiversity. The relationship between niche construction theory and the concept of ethodiversity is novel. In this sense, as we will see later, ethodiversity facilitates the understanding of some aspects related to biosocial studies such as the understanding of social and cultural inheritance, the relationship between the social and biological niche, etc.

Mesoudi et al. (2013) ask themselves about the role played by the non-genetic inheritance in evolution. The construction of niche, a phenomenon whereby organisms modify their own environments, also acts on descendant populations (i.e. it is inherited). Odling-Smee (1988) was the first to argue that niche construction should be included as an important factor in the evolutionary phenomenon. For example, the American beaver (*Castor canadensis*) is well known for building dams across streams and constructing their refugia in the ponds which they



have built, and this environmental transformation is inherited across generations (Müller-Schwarze and Sun, 2003). Many other organisms, humans included, inherit a modified environment, thanks to the behavior of the previous generations (Sukhovikhov and Gontier, 2021). But our social inheritance is inserted into a social transmission system that differs of animal inheritance in the complexity of the symbolic communication system (Buskes, 2013). Therefore, it is reasonable to think that organisms with greater behavioral variability (ethodiversity) will also have greater brain complexity. Ethodiversity could be understood in social organisms as varied behaviors which interact with niche in a joint process. Then, ethodiversity is related with behavioral variability, and in social organisms with social variability. Social interactions develop new characteristics that isolated individuals do not have, some of which will be collective properties and others “emergent properties”, which are difficult to predict from the elements of the system. Hölldobler and Wilson (2009) suggest the interpretation of societies as superorganisms, making an analogy between the cells of a multicellular organism and the individuals of a society. According to this idea, individuals locally adapted develop societies dependent of particular environmental characteristics and thus, societies would differ in their behaviour producing ethodiversity. Indeed, ethodiversity is a qualitative measure of the biological and sociological niche construction.

The human niche is then a conjunction of the environment in the biosocial sphere (Fuentes, 2017) in which operates the ethodiversity. Mesoudi et al. (2013) corroborate this perspective indicating that a gene-based approach may not be enough for social, cultural and even medical research. In fact, an evolutionary scientific perspective in social sciences that encompasses all the inheritance systems and the interactions between them is far more compatible with sociocultural phenomena. These phenomena are a set of behavioural vectors which give form to the social structure. In this sense, society is a structure of behaviors accepted in one way or another, by the individuals of the own society. That is to say that different organisms through conflict play their role in the social structure. During this sociality process, the organisms insert their life in scaffolding social structure in which each layer determines an increase of social complexity, and then a major necessity of diversity in behavior. This social scaffolding functions as a non-genetic mechanism of inheritance, just as culture does. It could be related to the developmental niche discussed by Stotz (2017), which does not coincide with the parameters of the selective niche, and involves

elements of exogenetic inheritance due to its linkage, according to this author, with aspects of psychobiological development. However, we cannot go into these issues at this time.

Some processes (like cultures and behaviours) are not linked to any alteration of the DNA sequence, but they are inherited thanks to mechanisms of cultural transmission/social learning (Mesoudi et al., 2013). Therefore, it is evident that the reticular coevolution between gene and culture has modulated the phenotypic diversity of human beings. In this process what happens from individual/genetic to collective/social behaviors has an important role in the adaptation to environmental heterogeneity (in time or space). The heterogeneity of local environments produces a plethora of micro-phenomena and behaviors, and all of this generates ethodiversity (Cordero-Rivera, 2017). The gene-culture process of coevolution could be summarized using the following sequence: individual inheritance-ethodiversity-social inheritances. These interrelationships just commented can be observed in Fig. 1.

### 3. Niche construction, social niche, and social complexity in biosociology

The number of papers about *social niche* has been increasing steadily. Saltz et al. (2016) published a review about this concept and showed that some authors define social niche as social groups, social environments, and different patterns of social interactions. These authors establish an integrative definition and consider two fundamental elements in their designation of the social niche. Therefore, they make a difference between social environments and social niche. Saltz et al. (2016) designate social environments as the set of behavioral and other interactions by a group of individuals. Social environments represent therefore a description of the social life of one or a set of individuals. In these environments, constant learning takes place within social groups that allow, in principle, the chances of survival to be increased.

Now, social learning is a complex phenomenon involved in different arrays of strategies of behaviours (ethodiversity) related with copying or imitative processes (Laland 2004; Bentley et al., 2011) and also related with socially learned innovations (Danchin and Wagner, 2010). These processes facilitate the generation and implementation of different norms and beliefs into the own group and between different groups (Boyd et al., 2010). Ethodiversity in complex organisms and humans includes social, sexual and so on behaviours. Furthermore, behavioural

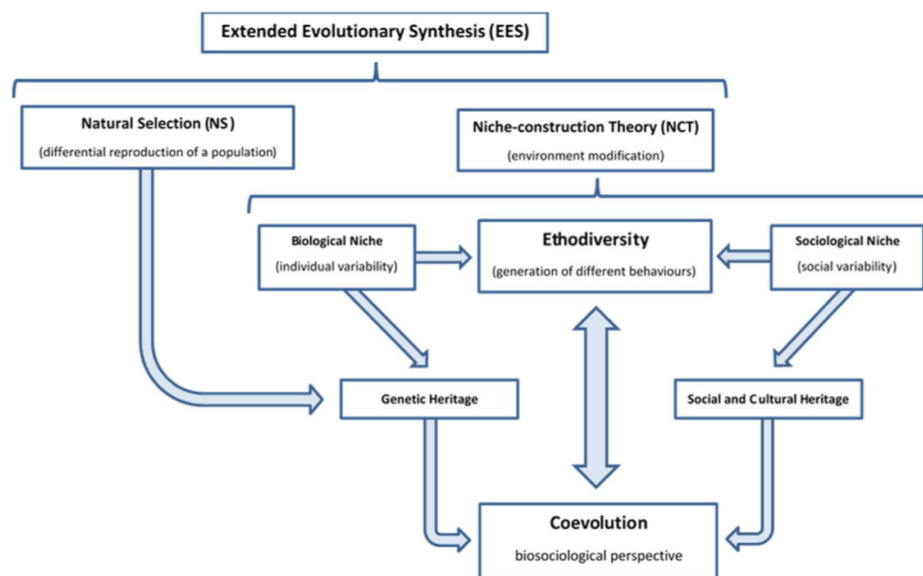


Fig. 1. Role of biological and sociological niches in the Ethodiversity-Coevolution interaction. (Source: Own elaboration).

diversity is linked to processes of innovation and diversification, which in human contexts favour *sociogenesis*, because behavioural alternatives could bring itself new structural modes of organization. The ethodiversity among groups could also function as a stabilizer of society through imitative processes. In fact, Moore et al. (2018) highlight the similitude between adaptation and transformation. They encourage an integrative perspective of these concepts, defining adaptation as the capacity to respond to changes, and transformation as the capacity to create new entities or pathways. These ideas are very useful for the aims of this paper to explain the double face of ethodiversity (*sociostasis* and *sociogenesis*), remembering that ethodiversity includes sociobiological elements, sexual behaviours and culturally-transmitted elements.

In eusocial organisms, ethodiversity does not always generate imitative processes, but is behind innovation. In this sense, Hills et al. (2015) show that in self-organized social domains people can self-assign roles that increase diversity in order to seek solutions. Furthermore, Moore et al. (2018) expose that diversity is very important in social innovation behaviors. Ethodiversity could be considered as one of the major conceptual complements of the NCT, due to the necessity to fit the organism behaviour with its environment. This interrelation between behavior and environment will be conditioned by the complexity of the environment. In this sense, and from the perspective of the social niche, organisms that are capable of building more complex societies will, in principle, need to establish more complex behaviors. However, this relationship between behavior and environment cannot be considered linear, since -as we have seen-the complexity of the niche (social, biological, cultural, etc.) can be great. Social systems are really very complex, and their diversity is a main epistemological factor in the social explanations. Also, diversity is a multidimensional element of reconfiguration of social structure (Vertovec, 2017). This author reviewed a set of papers in which different authors use the concept of diversity or super-diversity in order to show the great complexity of social systems in different ways (Aspinall and Song, 2013; Crul, 2016). According to that, in sociological research the diversity is analyzed as a structural factor: race, ethnicity, etc. Instead, in this work we consider the use of functional diversity as a categorical element, and not the structural diversity. Also, ethodiversity refers to the ecological system and therefore it is not only a sociological concept; it is a biosociological concept.

We have argued that ethodiversity could help to explain and measure the internal processes in social niches, the variability of sexual behaviours, cultural evolution, and even the increase or decrease of variability. Then, ethodiversity is the heuristic concept to explain social complexity and different *sociotypes* (behavioural types in eusocial organisms) in a concrete society. Ethodiversity let us to explain the existence of behavioural social types. If a set of behaviours  $x$  in an organism (included humans) is different to another set named  $y$ , it could be possible to consider two different sociotypes. The sociotype is then a functional group and in humans “the sociotype means both the bonding structures of the social environment and the dynamics of social interactions to which individuals of our species would be evolutionarily adapted” (Marijuán and Navarro, 2020). Marijuán et al. (2019) and Marijuán and Navarro (2020) empirically verified the similar fabric of the social world in the individual life. In this sense, each social group will have a particular behaviour which could be differentiated from the others, and it could affect the evolution of this social group. Our work is influenced by the concept of sociotype, however we believe that this same concept could be extended to different social organizations. In this expanded sense of the sociotype concept, ethodiversity plays a prominent role as a structuring mechanism. Then we propose that ethodiversity is another causal mechanism that could be considered in the structuration of the causal ontology of the social evolution in organisms in which niche also has a lead role (Fig. 1).

Watling and Neal (2013) argue that all ecological systems (and also niche) should be conceptualized as a network, where each defined subsystem has social relationships surrounding a focal group of individuals, and where this subsystem at different levels relate to one

another in an overlapping but non-nested way. The social niche could be therefore conceptualized as a network in which individuals are not the unique elements; in fact, non-genetic inheritance can be included in the social niche, like geography, language, memes, and so on.

Non-genetic information may affect to evolution through the cultural phenomena that are analogous to DNA transmission according to memetic theory. Also social learning can be transmitted and shape the social evolution (Kulahci and Quinn, 2019). Obviously, according to niche construction theory, the niche also has a major relevance in the evolution of life. To all this it should be added that there are differences in the processes of transmission of information of an evolutionary nature. Genetic information is transmitted vertically (from progenitors to descendants), while cultural information is transmitted horizontally (between organisms of the same generation), although there is also oblique (between organisms of different generations, and between unrelated individuals of different generations) transmission of information. Finally, as indicated by Danchin and Wagner (2010), there are innovations that are transmitted rapidly, affecting the behavior of the population.

Danchin and Wagner (2010) developed a mathematical model in order to know trait variances of organisms. In their model these authors take into account genetic variance and non-genetic transmitted variance (which includes epigenetic variance, transmitted parental effects variance, transmitted habitat inheritance and transmitted social variance). Then, it could incorporate environmental conditions, psychological health, political conditions, economic conditions, and so on (Troyer, 2002) as part of the social niche. Also, it could be encompassing human behaviors/human ethodiversity, human perceptions or even all cultural factors potentially inherited (Laland and Brown, 2011; Toth and Szigeti, 2016). Definitively, ethodiversity operates as a heuristic item that allows to explain how social dynamics and evolution operate, but this concept needs more research in order to improve its heuristic utility.

Ethodiversity is a biosociological concept that could explain the social mechanisms to generate order, disorder, simplicity, complexity and so on. Also, ethodiversity could help to explain and measure the internal process that generate social niches, sexual variability, cultural evolution, and even the increase or decrease of variability on society. Saltz et al. (2016) affirm that the potential role of social niches is the maintenance of variability in behaviors, analogously to the existence of niche differences supporting species coexistence. This idea has been denominated *normativity* by Margaret Archer. Then, according to that, it seems that the social niche generates a set of control mechanisms (which in human and social organisms could be named *normativity*) which leads the diversity of behaviors (ethodiversity) and establish a set of main behaviors that operate as steering factor of this ethodiversity. In this sense, the reader could be wondering if these biosocial focuses, centred in ethodiversity, are determining the human society.

In this sense, ethodiversity let us to explain the behavioral social types. If it is determined a set of behaviors in an organism  $x$  ( $x_1, x_2, x_3 \dots, x_n$ ), and this set is different from another organism  $y$ , this would mean *interspecific ethodiversity*. Also, in a same species  $x$  it could be possible *contradistinguishing* between two groups ( $a$ , and  $b$ ) with different behaviors, i.e., *intraspecific ethodiversity*. Furthermore, we can also consider another ethodiversity level related with the degree of complexity of a particular behavior; *complexity ethodiversity*. By last, we could consider the existence of a further type of ethodiversity, named *social ethodiversity*, which can distinguish among social organisms, non-social organisms, and proto-social organisms.

According to this, it will be possible to generate a behavioral matrix to categorize sociotypes in a determined species or differences among species. Now, it is necessary to be aware that sociotype and ethodiversity will vary more in eusocial organisms than in non-social ones. Otsuka explains that the causal factors to promote the biological evolution are the fitness, the phenotype, the offspring, the epigenetic and the niche (Otsuka, 2019). However, ethodiversity operates as another causal mechanism that could be considered in the structuration of the causal



ontology of the social evolution in social organisms. Definitively, ethodiversity may be a main complement to the Niche Construction Theory and above all it will be of applied use in all kinds of social organisms.

#### 4. Conclusion

Wilson (2014) and the sociobiological approach formalized at the end of the XX century that sociological research could learn about behavior of the organisms in order to increase the knowledge of human behavior. Sociobiology has been misunderstood and it has been mostly ignored by sociology (Cordero-Rivera, 2017). Recently, niche construction theory and also the social niche proposal have revitalized a biosociological perspective that has major interest in sociological studies. In this paper it is exposed an epistemological framework that contributes to structure future research about this integrative perspective. In this context, the concept of ethodiversity has recently emerged as a concept that allows explaining some aspects of causality in social organisms, namely the human social system.

The concept of ethodiversity has the capacity to explain some aspects of the social or presocial behaviors of organisms. It also allows comparisons to be made between subspecies or between species of the same genus. In addition, it makes it possible to explain more clearly the *continuum* that occurs in the biosocial framework.

However, there are still many aspects that need to be clarified. For example, it is not yet well established how ethodiversity could collaborate in the understanding of non-human sociotypes. All this shows us that the challenges opened up by the concept of ethodiversity are broad and exciting. We hope that future research will help to comprehend the interrelation among inheritance processes, biological niche and social niche.

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J.R. Coca et al.

BioSystems 210 (2021) 104552

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